REMARKS/ARGUMENTS

Claims 1-20 are active.

Claim 1 is amended to provide:

1) wherein the catalyst is obtained by impregnating Ru in the TiO_2 support, which disclosed in the specification on page 4, line 39 to page 5, line 1

2) said catalysts have a pore volume of from 0.1 to 1m/g, which is disclosed in the specification on page 5, lines 24 to 29; and

3) said catalysts have a BET surface area of from 5 to 500 m^2/g, which is disclosed in the specification on page 5, lines 24 to 29.

No new matter is added.

The rejection of the claims as being obvious in view of DE 101 52 525 and WO 99/11615 has been maintained. As explained previously, referencing the specification, the data presented in the application clearly show, the Ru/TiO_2 catalyst (4) performed significantly better than the copper, cobalt and nickel based catalyst as particularly exemplified in the DE '525 application.

To achieve the high conversion of formate, the catalysts of the present invention are catalysts in which ruthenium is supported on titanium dioxide wherein the catalyst is obtained by impregnating Ru in the TiO_2 support.

This fabrication method results in catalysts with a high pore volume and a high surface area showing improved catalytic efficiency while requiring only small amounts of (0.1 to 10% by weight) of active catalytic material (Ru). The features are provided in amended claim 1. None of the references cited suggest that such an impregnated catalyst, nor that an increase in the catalytic performance is obtained by the distinct combination of parameters as defined in the claims. Nor can the distinct combination of features be considered to be a result of routine experimentation.

In Item 6 in the "Response to Arguments" the rejection purports to have considered the previous rejections but argued that the Applicants prior comments were not to be persuasive because the advantages of the catalysts of the present invention cannot be attributed to the catalyst material and the carrier alone. The arguments are allegedly supported by the table on page 9 of the specification of the present invention, which purportedly shows a great disparity between the ratios of "amount catalyst" used in the respective examples to "formate % by weight", which allegedly denotes the amount of formate present in the reaction mixture at the beginning of the reaction.

Further support for this position in the Action is based on calculations as per the following values for the ratio of "amount catalyst": "formate % by weight":

Example 1: 48:1 (18.6 g : 0.39%),

Example 2: 25:1 (27.7 g: 0.51%),

Example 3: 118:1 (21.3 g : 0.18%),

Example 4: 2467:1 (14.8 g : 0.006%).

Applicants respectfully point out that the calculations are misplaced and reliance on those calculations and, indeed, the rationale in the rejection is not correct and as such discounting the data presented in the application is not appropriate.

The calculations upon which the Office relies did not calculate the ratio of "amount catalyst" to "formate present in the reaction mixture <u>before</u> decomposition" but has rather determined the ratio of "amount catalyst" to "formate present in the reaction mixture <u>after</u> decomposition".

As the catalysts of the present invention are more effective than the catalysts of prior art, it is perfectly understandable that the ratio of "amount catalyst" to "formate present in the reaction mixture <u>after</u> decomposition" is significantly higher for the catalysts of the present

invention since only trace amounts of formate remain after decomposition. The catalysts of prior art are less efficient. This is reflected by the fact that the ratio of "amount catalyst" to "formate present in the reaction mixture after decomposition" is significantly smaller.

Therefore, the Office "response" that the differences in catalyst efficiency cannot be attributed to the catalyst material and the carrier alone are based on false premises.

Contrary to the Office's assertions, the difference of catalyst efficiency is both statistical and practical significance.

This can be shown from Examples 1 to 4 of the present invention. In all Examples, a TMP-containing reaction mixture containing 0.57% ($[\text{Formate}]_{\text{Beginning}}$) by weight of trimethylammonium formate was treated with hydrogen at 180°C and 90 bars for 60 minutes in the presence of different catalysts as indicated in the table on page 9 one of the present invention. After the reaction, the remaining amount of formate ($[\text{Formate}]_{\text{End}}$) was determined analytically.

The rate of conversion (v) can be estimated from Experiments 1 to 4 using following approximation:

$$v = \frac{d[\text{Formate}]}{dt} = \frac{[\text{Formate}]_{\text{Beginning}} - [\text{Formate}]_{\text{End}}}{60\text{Minutes}}$$

$[\text{Formate}]_{\text{Beginning}}$ is equal to 0.57% by weight in all cases.

$[\text{Formate}]_{\text{End}}$ is 0.39% by weight in Experiment 1, 0.51% by weight in Experiment 2, 0.18% by weight in Experiment 3 and 0.006% by weight in Experiment 4.

Therefore the rate of conversion can be approximated to be:

Example 1: 0.003 % by weight/minute,

Example 2: 0.001 % by weight/minute,

Example 3: 0.006 % by weight/minute,

Example 4: 0.009 % by weight/minute.

The rate of conversion is approximately a factor 1.5 higher in inventive Example 4 compared to comparative Example 3 and even higher compared to Example 1 (factor 3) and Example 2 (factor 9).

It must also be considered that the amount of active metal is lowest in the catalyst of the present invention.

The catalyst used in Example 1 includes 40% CuO, 20% Cu and 40% TiO_2 (see page 7, lines 27 to 28 of the present specification). The fraction of catalytic material is 60%. Of the 18.6 g of catalyst which were used in Example 1, approximately 60% are catalytically active. This amounts to 11.2 g.

The catalyst used in Example 2 is a catalyst prepared according to Example 1 of EP 0672452 and includes 74.5% NiO_2, 14.7% SiO_2, 5.4% Al_2O_3, 4.5% ZrO_2. As SiO_2, Al_2O_3 and ZrO_2 are carriers, the fraction of active catalytic material is 74.5%. As 12.7 g of catalysts were used in Example 2, the amount of active material in Example 2 is equal to 9.4 g.

In Example 3 a catalyst prepared according to the example of EP 0742045 was used. This catalyst contained 90% Co, 5.4% Mn, 2.8% P and 0.16% Na. The active catalytic material amounts to approximately 95%. The amount of active catalytic material used in Example 3 can therefore be calculated to be approximately 20.2 g (21.3 g x 95%).

The catalyst of the present invention has a Ru content of 0.1 to 10% according to Claim 1. In Example 4 of the present invention a catalyst having a Ru-content of 4.2% was used. Therefore only 0.62 g of active catalyst material (4.2% x 14.8 g) was present in Example 4. To be able to compare experiments in which different amounts of active catalyst material are used, it is necessary to normalize the rate of reaction (v) with the amount of active material (w).

The ratio of $\frac{v}{w} = \frac{Rate\ of\ Conversion}{Amount\ of\ Active\ Catalyst\ Material}$ can be calculated to be:

Example 1: 0.003 / 11.2 = 0.00027 (2.45)

Example 2: 0.001 / 9.4 = 0.00011 (1)

Example 3: 0.006 / 20.2 = 0.0003 (2.7)

Example 4: 0.009 / 0.62 = 0.0145 (132)

Therefore, the rate of conversion per gram active material is a factor **132 times higher** for the catalyst of the present invention compared to the catalyst of Example 2 and approximately a factor **50 times higher** compared to the catalysts used in Examples 1 and 3.

The high efficiency of the catalysts of the present invention is of both statistical and practical significance and can only be explained by the surprising and unexpected effect achieved by the combination of Ru as active metal and TiO_2 as a carrier material.

Further, the difference between the present invention and cited art, in particular DE'525, does not only lie in the selection of Ru as a particular active material and TiO_2 as a particular support material alone.

An important feature of the present invention is the fact that the catalyst of the present invention is a catalyst in which Ru is supported on TiO_2. Such catalysts can be obtained by applying the active ruthenium component in the form of a ruthenium salt solution to the titanium dioxide support, using one or more impregnation steps (page 4, line 39 to page 5, line 1 of the present specification).

The feature "Ru supported on TiO_2" is therefore a technical feature which characterizes a method of manufacture of inventive catalysts. The object of the present invention is therefore an impregnated catalyst in which Ru is supported on TiO_2. Such catalysts are also characterized by a high surface area and a high pore volume which allow an easy access of reactants (formate) to the catalytically active sites (Ru) dispersed on the surface of the catalyst.

The catalysts of cited art, especially those in DE'525 are not impregnated catalysts in the sense of the present invention. Rather the support material is used as a binder or adhesive to kit the active material together. For example, the catalysts mentioned in DE 19809418 are obtained by mixing copper powder with TiO_2 powder. Such a process of manufacture does not constitute impregnation. In EP 0673452 and EP 0742045 the catalysts are obtained by co-precipitation of salts of active components and salts of the support material. This sort of process can also not be considered to be an impregnation process. Therefore, impregnated catalysts are not suggested by cited art.

Reconsideration and withdrawal of the rejection is requested.

A Notice of Allowance is also requested.

Respectfully submitted,

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